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IN THE 1950'S SOMETHING HAPPENED

IN A FEW, SMALL LABORATORIES IN

MASSACHUSETTS THAT HAS TRANS-

FORMED THE WORLD FOREVER.

IT IS ABOUT TO HAPPEN AGAIN.

Whirlwind I computer built in the early 1950's in the now disbanded M.I.T. Digital Computer Laboratory, Cambridge, Mass.

THE SPECTACULAR STATE OF

ACHIEVEMENT THAT LAUNCHED THE

COMPUTER REVOLUTION IS EMBARK-

ING ON A BOLD NEW VENTURE.

MASSACHUSETTS IS TAKING THE

LEAD IN THE EMERGING TECHNOL-

OGIES OF THE NEXT CENTURY

WITH A POWERFUL NEW ALLIANCE

OF BUSINESS, UNIVERSITIES AND

STATE GOVERNMENT.

GOVERNMENT DOCUMENTS
COLLECTION
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University of Massachusetts
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THE CONCEPT:

CREATING THE FUTURE

Look closely at the high-tech, essentially microelectronics, industry of Massachusetts today. Its beginnings can be traced to the electronics and defense firms that spun-off from MIT and nearby universities several decades ago.

The crucial role played by academia in providing people and research to spawn entrepreneurial activity is clear. Digital Equipment Corporation (DEC) was started by two employees leaving MIT's Lincoln Labs in the 1950's. Today, DEC employs 17,000 Massachusetts residents and is a world leader in microcomputers.

Data General, another world leader, was started by employees leaving Fairchild Semiconductors and DEC in the 1960's. Wang Laboratories was founded by Dr. An Wang in 1951 after he finished post-doctoral study at Harvard's Applied Physics Labs. Wang Labs now offers jobs to 24,000 people in Massachusetts.

These, and related stories, add up to one fact: Massachusetts has worldwide stature in high technology today. Sixty percent of the U.S. microcomputer market is currently claimed by Massachusetts firms. 240,000 Massachusetts employees—forty percent of our manufacturing workforce—work in high-tech firms. This is the highest percentage in the nation.

Another fact is important to note: high technology firms played a crucial role in the state's recent economic development—as the largest source of exports; as the largest source of investment in capital equipment; and as the reason why Massachusetts fared better relative to other older, industrial states in the recent recession.

In the first Dukakis Administration, public officials from state planners to specialists in environmental affairs, transportation, and community development marshalled policies and programs to revitalize the downtowns of older urban cities and towns.

We demonstrated that public policy efforts could shape, in fact, dramatically affect, our future.

Nine years later, we are undertaking to apply all these lessons to these questions: Can we put in place the public, private, and academic forces to create the next generation of high technology? Can we systematically reinforce our competitive intellectual edge, our deeply ingrained entrepreneurial energies, our respect for private institutions, and our belief that state government can help create an economic future shared by all Massachusetts citizens?

We believe we can.

To do this, the Dukakis Administration proposes an ambitious new program called the Centers of Excellence.

MASSACHUSETTS' NEXT GENERATION OF HIGH TECH INDUSTRIES

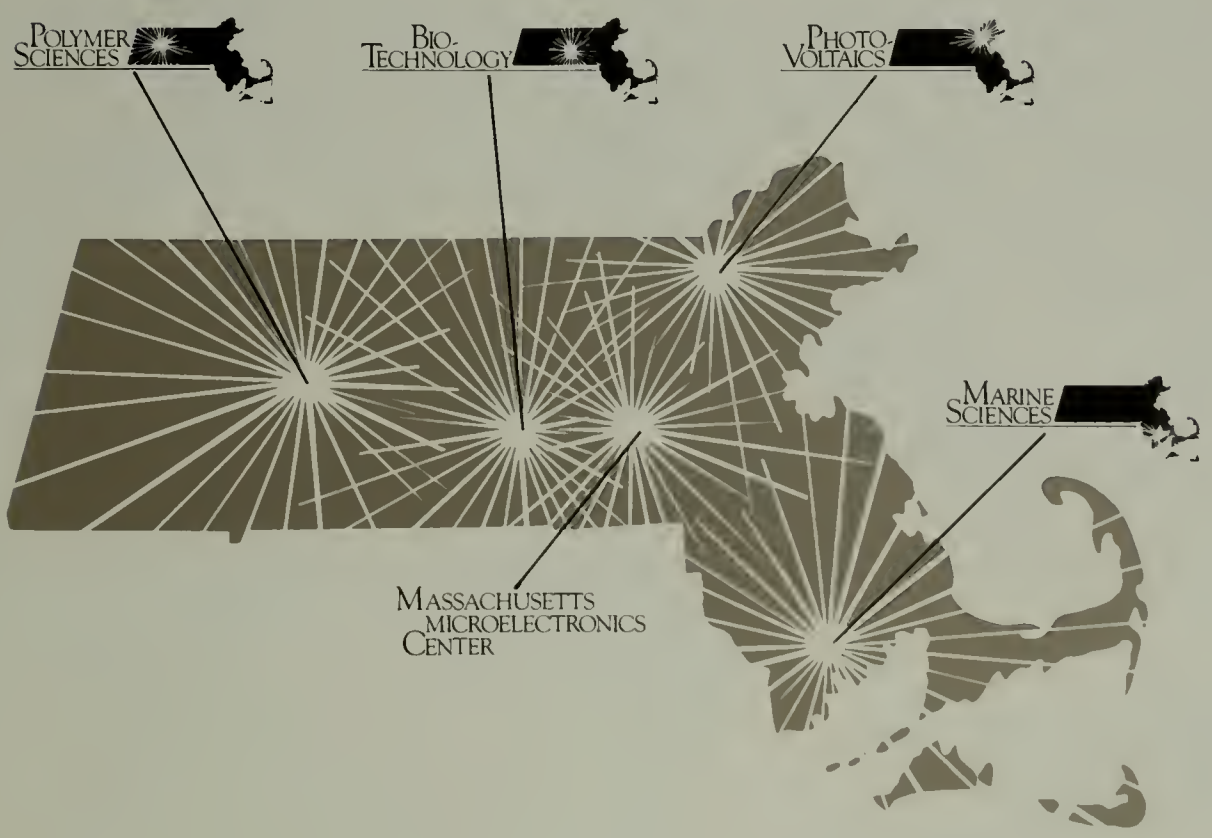
Located in distinct areas of the state, Centers of Excellence will be developed around a specific emerging technology and institutions of academic excellence. Our goal is to establish each center and its surrounding geographic area as both the academic and economic world leader in the following disciplines:

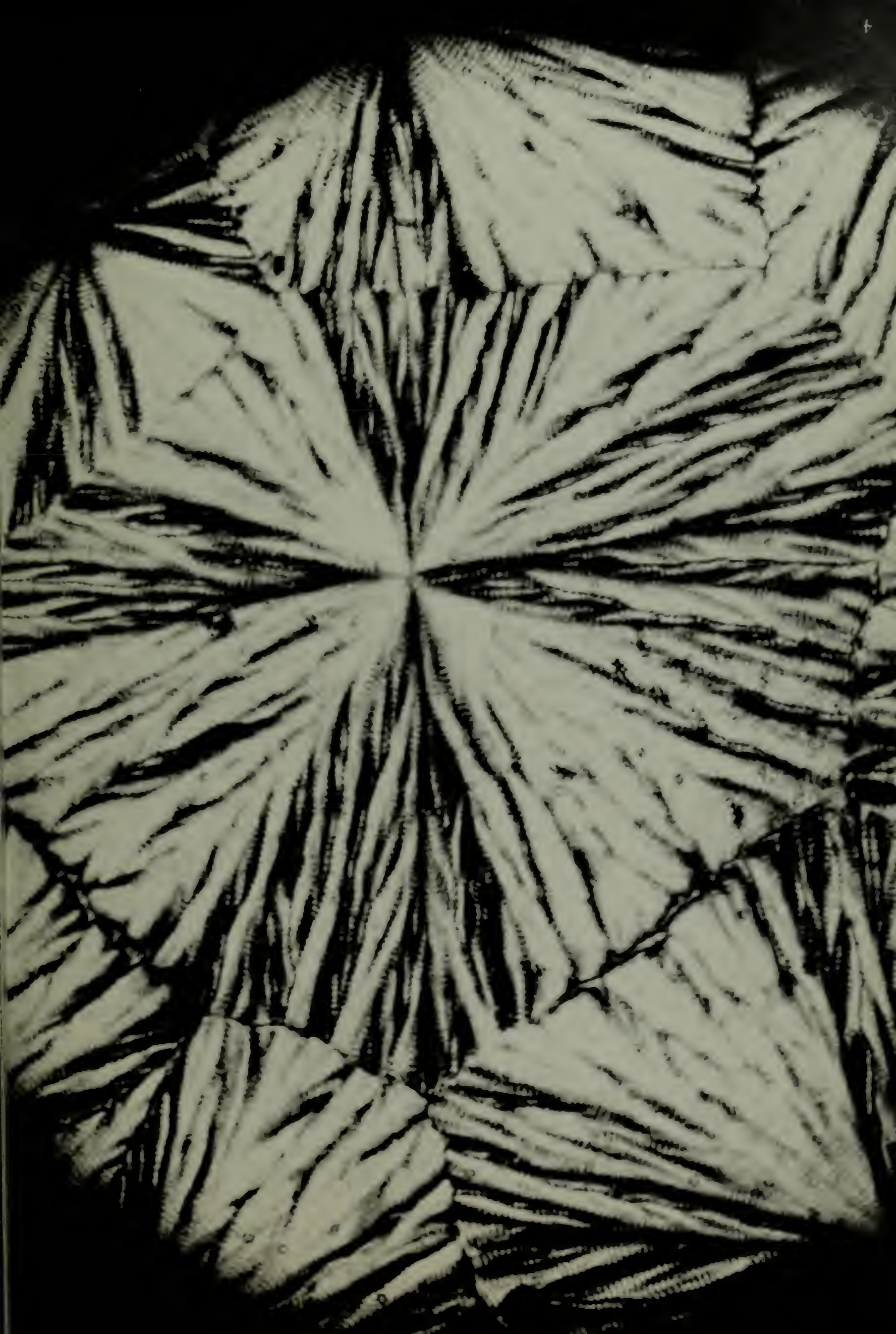
POLYMER SCIENCE tied to the University of Massachusetts, Amherst and the investments of Monsanto at Orchard Park and General Electric in Pittsfield.

BIOTECHNOLOGY centered at Worcester's Biotech Park being developed next to the University of Massachusetts Medical School and led by the Worcester Business Development Corporation and members of the Worcester academic consortium.

MARINE SCIENCES concentrated along Massachusetts' coast particularly in southeastern Massachusetts, where the world famous marine research institutions of Woods Hole as well as Southeastern Massachusetts University, and the Massachusetts Maritime Academy are located, and in Boston where the University of Massachusetts/ Boston harbor campus is situated.

PHOTOVOLTAICS centered around existing photovoltaic research and development companies located in northeastern Massachusetts together with MIT and the Productivity Center of the University of Lowell.





POLYMER SCIENCES:

BREAKING THE BARRIERS OF WEIGHT AND FLEXIBILITY.

Polymers are long-chain molecular compounds that have unique properties and characteristics. There are three basic types of polymers, based on their physical characteristics: fibers, elastomers, and plastics.

Polymers dominate today's materials industry and play a key role in dozens of other industries as diverse as oil recovery and health care. They are essential in fulfilling a broad range of national needs in such areas as energy, agriculture, food processing, medicine, and national defense.

The University of Massachusetts at Amherst has the largest and one of the best university polymer programs in the country:

- The thirteen polymer-related faculty published 123 papers in reference journals during the past year.
- A total of 150 polymer students and faculty are currently in residence with 90 graduate students working toward Ph.D. degrees.
- Research sponsored from non-University sources totalled $4,041,000 in 1983.
- One of the two National Science Foundation-supported Materials and Research Laboratories in polymer science is located at UMass.
- Seventeen major chemical companies have joined to establish one of the first Industry-University Centers in polymer science on the Amherst campus.

The University is now seeking to establish the Center for Polymer Science on its campus to meet a national need. The Dukakis administration and the Legislature are supporting this effort and have authorized $6 million in the state's FY'84 capital outlay budget for this purpose. The University has also received indications of private industry support and is presently seeking matching federal funds.

Primarily because of its proximity to UMass, General Electric Company has built its international research center in Pittsfield, and Monsanto with its 300 scientists has developed close ties between its Orchard Park facility and the University. In December of 1983, the first polymer-related firm to locate in Amherst opened its doors with the Secretary of Economic Affairs presiding. It joined the more than 400 polymer companies in Massachusetts whose sales last year equalled $3.5 billion and which provided more than 33,000 jobs.

Polyvinylidene fluoride (polymer) crystal, magnified 400x, that generates electricity when subjected to pressure—often used in phonograph needles and loudspeakers.

BIOTECHNOLOGY:

UNLOCKING THE SECRETS OF LIFE ITSELF.

Biotechnology uses living organisms to make or modify products, to modify plants or animals, or to develop micro-organisms for specific industries such as agriculture and medicine.

Some specific techniques include:
RECOMBINANT DNA TECHNOLOGY—The development of micro-organisms that produce new products, improve existing production methods, or create large quantities of otherwise scarce products, such as human insulin and new strains of agriculturally important plants.

CELL FUSION—The artificial joining of cells that combine the desirable characteristics of different types of cells into a single cell; for example, to create monoclonal anti-bodies which can be used in the diagnosis and treatment of disease and the purification of proteins.

These technologies are the basis for the growing biomedical research and development industry which the Worcester Business Development Corporation, together with local and state government, is actively working to attract to the Worcester Bio-Tech Park.

The Worcester Business Development Corporation, an affiliate of the Worcester Chamber of Commerce, is the primary economic development organization for the City of Worcester. It has already successfully developed and marketed a half dozen industrial parks providing employment for over 6,000 people and over $2 million in municipal tax revenues.

Located on approximately 100 acres adjacent to the University of Massachusetts Medical School and its 350 bed hospital, the Park is convenient to the strong academic and medical institutions that exist in the Worcester area.

They include:

- Six outstanding teaching hospitals affiliated with the UMass Medical Center;
- The Worcester Foundation for Experimental Biology, an eminent freestanding biological research institute;
- Tufts University School of Veterinary Medicine;
- Harvard University Primate Research Center;
- Eight colleges and universities including Worcester Polytechnic Institute which boasts a nationally-known biomedical engineering program and Clark University with its nuclear magnetic resonance laboratory.

An integral part of the Bio-Tech Park will be an innovation center with a totally-equipped conference facility; a biotechnology information clearinghouse and library; an incubation center for small, growing businesses; a technology center to encourage the development of instrumentation; flexible office and laboratory facilities; and a fermentation scale-up facility to serve park tenants on a leased time-sharing basis. The Dukakis Administration has awarded a $50,000 planning grant to the Worcester Business Development Corporation to help with the initial phase of this project and is providing additional support from the Executive Office of Economic Affairs and the Governor's staff.

BIO-TECHNOLOGY

Roller bottles containing mammalian cells genetically engineered to produce human fertility hormones.

MARINE SCIENCES:

REALIZING THE POTENTIAL OF THE WATER PLANET.

A product of a broad range of disciplines including physics, chemistry, biology, geology and engineering, marine research can play an enormously important role in the economic development of the fishing industry, ocean mining, ocean and tidal energy production, marine electronics, cargo transport, aquaculture, mariculture and the recreation and tourism industry.

Woods Hole is the undisputed world capital of scientific research and technological development in the marine sciences. It is a complex of two private institutions and three federal facilities. The scientific community at Woods Hole has earned its reputation through nearly 100 years of sophisticated research in ocean, coastal and estuarine waters.

Southeastern Massachusetts University has had a strong marine orientation since its inception. Its 730 acre North Dartmouth campus is located only 15 minutes from a variety of maritime habitats ranging from the unspoiled estuaries and barrier beaches of Westport and South Dartmouth to the busy commercial harbors of New Bedford and Fall River.

The University's academic program and faculty reflect its marine orientation. SMU is the only institution of higher learning in southeastern New England to offer specifically designated B.S. and M.S. degrees in marine biology. Half of its biology majors and growing numbers of chemistry students have a strong interest in marine science. Two-thirds of the biology faculty have research and teaching expertise in marine biology.

SMU is now developing programs in aquaculture and mariculture in an effort to expand the knowledge about growing aquatic organisms under controlled conditions. The economic potential is evident in the fact that there are over a dozen commercial facilities specializing in aquaculture and related fields in Southeastern Massachusetts at the present time. However, technologies for developing increased yields and new products need to be developed to strengthen this emerging industry. The Executive Office of Economic Affairs is supporting such efforts at SMU and other institutions.

The University of Massachusetts, Boston, with its well equipped laboratories and dock facilities is surrounded on three sides by the waters of Boston Harbor. The University through its Ph.D. program in Environmental Science and the Department of Biology Master of Science in Applied Marine Ecology trains graduate students in several specialities to confront and solve marine environmental problems. A proposed Institute for the Study of Urban Harbors to be located at the University of Massachusetts/Boston will complement the current programs and will be a unique national facility. Focusing on Boston Harbor and coastal waters, faculty and graduate research is concerned with the gathering and analysis of data on marine pollutants. These research groups are supported by federal grants and commonwealth funds.

The additional resources of Massachusetts Maritime Academy in Buzzards Bay, Cape Cod and Bristol Community Colleges, and MIT through its Sea Grant Program can all contribute to the creation of an unparalleled marine science center of excellence along Massachusetts' coastline.

Coastal environment, Woods Hole, Mass.—focus for new technologies in marine research and development.

PHOTOVOLTAICS:

HARNESSING THE PERMANENT ENERGY SOURCE.

Photovoltaics (pv) is an emerging technology that transforms the sun's rays directly into electricity without noise, pollution or any moving parts.

This technology already plays an important role in the state's economy. Recognized as one of three U.S. regional photovoltaics centers, Massachusetts' photovoltaic industries in 1983 had combined sales of $30.3 million, representing 51% of the U.S. market and 28% of the world photovoltaic market.

Projections forecast that under favorable conditions the Commonwealth's share of this market could grow to $87 million in 1987, $435 million in 1990, and $4.3 billion by the 21st century. The Dukakis Administration, through the Centers of Excellence, is working to see that these projections are met.

Working with the state's photovoltaic companies, state government is pursuing the following projects to encourage photovoltaic development here:

- Applications on state highway, marine and railroad facilities.
- The creation of an export marketing association.
- A village demonstration project.
- Field testing of residential photovoltaic systems.
- A pv-powered electric generating station.

The Massachusetts Institute of Technology is unquestionably one of the leading engineering universities in the world. In 1976, the MIT Energy Lab, established by the U.S. Department of Energy, began research and development of cost-effective, safe, reliable residential solar photovoltaic systems.

The University of Lowell is a recognized leader in research and development of industrial technologies. The University is currently planning a major new Productivity Center to further the state's economic activities in computer-related areas by:

- enhancing productivity via automation.
- integrating technical and managerial skills.
- developing a "Model Factory of the Future."

The Executive Offices of Economic Affairs and Energy Resources are supporting research in production techniques that will be of critical importance to the photovoltaic industry as well as other emerging technologies as they mature and gear up for mass production.

PHOTO-VOLTAICS

Photovoltaic cells cut from silicon ribbon convert sunlight into electricity.

30KV X 700 10U 005
DC1980 LOT#2000 HL
30KV X 700 10U 004

MICROELECTRONICS:

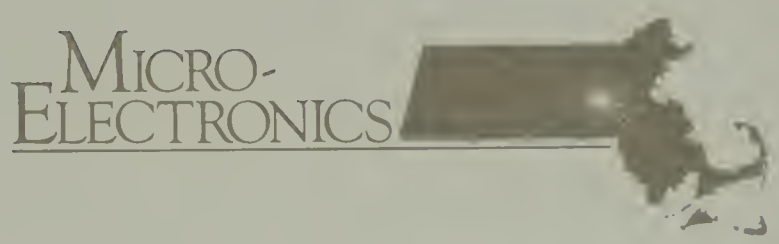
CONNECTING THE FUTURE.

Serving as a linchpin to the above technological initiatives will be the new Massachusetts Microelectronics Center, a $40 million facility jointly funded by the Commonwealth of Massachusetts and private industry. Scheduled to open in 1985, the Center will be developed and operated by the Massachusetts Technology Park Corporation, a quasi-public agency of the state. Located in Westboro, the Center will provide advanced educational opportunities to Massachusetts engineering students, faculty, and industry employees on a full-time and continuing education basis in computer-aided design and semi-conductor fabrication and processing.

The Dukakis Administration through its representation of the Secretaries of Economic Affairs and Administration and Finance on the MTPC board will be working closely with private industry to carry out its mandate.

The Microelectronics Center will be of particular importance to all Centers of Excellence. For example, in polymer sciences, computers are used to model and evaluate stress analysis of materials; in biotechnology, computers render high resolution anatomic information about the existence of disease and the body's metabolism; in marine science, computers assist fish farmers in determining stocking densities and feeding schedules as well as in monitoring ocean currents; and in photovoltaics, computer-aided simulations greatly aid in the design of commercial and residential solar electric systems.

Our centers will not only be linked to the Microelectronics Center, but to each other as well. Development of polymer thin films can accelerate the commercialization of photovoltaics and passive solar homes. Photovoltaics, in turn, can eventually provide emerging new industries with an economical, non-polluting source of energy. Genetics and biochemical procedures for spawning and larval development will enhance the aquaculture industry.



A micro chip the size of an eye of a common fruit fly, both magnified 1,400x.

EXPANDING MARKETS:

HOME AND ABROAD

The Centers of Excellence will also play a significant role in strengthening our traditional industries. The modernization of our older industries through technological advances as well as the training of workers to meet the challenges of these new technologies will be woven into our Centers of Excellence program. Through the resources of the Executive Office of Economic Affairs, the Commonwealth has the capability of training, retraining, and upgrading workers from entry-level to advanced engineering. This range of programs is offered through the Bay State Skills Corporation, the Job Training Partnership Office, and the Division of Employment Security to mature and emerging industries alike.

Finally, recognizing the large international demand for state-of-the-art technological products and services, the newly created Massachusetts Office of International Trade and Investment within the Executive Office of Economic Affairs will focus its export efforts around the activities of the Centers of Excellence. Specific overseas markets will be targeted and export trade associations involving clusters of interested firms will be organized to assist in exploiting these markets. These trade efforts are intended to achieve a specific goal: the financing of Massachusetts research, innovation, and production capacity in these technologies.

The goal of the Centers of Excellence is clear. We aim to forge new partnerships with business, education and government to create a climate for academic research, technological innovation and economic growth second to none in the world. We recognize that the challenge from abroad is particularly formidable, but Massachusetts is ready to compete.

And we will compete in the time-honored tradition that has made Massachusetts so successful: with a workforce known and respected for its ethic and hard work, with a population that has always valued education, and with an entrepreneurial spirit that is advancing Massachusetts' leadership position in the emerging knowledge-based economy.

Logan Airport is the fastest growing International Gateway on the East Coast. More than 4,500 businesses including high tech use its airfreight services annually.

FLYING TIGERS
BOEING 747
TWA

"My strong belief that innovation is at the heart of our ability to compete in a world economy and produce sustained economic growth at home led to my decision to include the concept of the Centers of Excellence in the 1984 Democratic National Platform."

Governor Michael S. Dukakis

"In the past generation, scientists and engineers together with educators and business leaders throughout the United States have begun countless new high technology businesses such as those in Massachusetts . . . to establish this country as a leader in the next generation of high technology industries. [We] encourage and support Centers of Excellence that foster the cooperation of academic and entrepreneurial excellence, thereby strengthening our scientific and technological resources and creating tomorrow's jobs."

Excerpt from 1984 Democratic National Platform
Michael S. Dukakis, Chair-Jobs,
Economic Growth and Prosperity Committee

"Recognizing that change is necessary and inevitable, my top priority as Secretary of Economic Affairs is to keep Massachusetts competitive with other industrial states–both domestic and foreign.

We can accomplish this by encouraging government, corporate and academic partnerships for technological innovation in our emerging and mature industries.

Here in Massachusetts we have a strong foundation on which to build our economic future.

The Centers of Excellence provide the vision and the blueprint."

Evelyn F. Murphy, Secretary
Executive Office of Economic Affairs

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CENTERS OF EXCELLENCE

The Commonwealth of Massachusetts:
Michael S. Dukakis, Governor
Evelyn F. Murphy, Secretary of Economic Affairs